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BASIC CHEMICALS IN UAR

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INTRODUCTION

Basic chemicals can be defined "as those chemicals which are produced in large quantities usually at low cost. They generally serve as raw materials or treating agents for other process industries".

This report has been prepared in accordance with the definition mentioned above. Hence the scope of the report covers various industries including: acid and alkali industries, other inorganic chemicals, some organic substances and derivatives, industrial gases, coal carbonization dye-stuffs, and petrochemicals. Chemical fertilizers are dealt with separately in another report.

Prior to 1952, basic chemicals industry in UAR was not given due consideration owing to the fact that industrial development during that period proceeded slowly; besides no comprehensive economic plan governed this development. Moreover, private capital did not find great interest to participate in developing basic industries mainly because these industries require high initial capital cost and do not usually give reasonable return on investment.

The Government authorities of UAR paid considerable attention to the establishment and development of chemical industry and in particular the basic chemical industry soon after 1952. Table 1 shows the considerable growth of output in chemical industry as compared to that of the other branches of the manufacturing industries. It is evident from Table 2 that the output in chemical industry increased from 33 million pounds in 1952 to 135.1 million pounds in 1963. Table 2 gives the capital invested and to be invested in chemical industry in UAR in the first and second five year plans and the share of the basic chemicals industry in such investments.

TABLE 1

Output of manufacturing industries-value in million Egyptian Pounds % represents output related to output of 1952

Industry	1952		1957		1958		1959		1960		1961		1962		1963	
	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%
Textile	84,6	100	147.9	175	156.8	185	183.4	216	230.5	272	258.7	305	286.2	340	316.7	375
Food manufacturing	122.3	100	163.5	134	154.9	127	164.1	134	177.1	144	170.1	138	197.9	162	222.1	182
Chemical*	33	100	61.5	187	64.3	195	70.4	213	76.8	233	88.9	270	113.7	345	135.1	410
Engineering and metallurgical	26	100	41.6	160	46.9	181	55.1	212	73.1	282	80.5	310	106	407	136.3	524
Total	265.9	100	414.5	156	422.9	159	473.0	178	557.5	209	598.2	225	703.8	264	810.2	305

* Includes leather tanning and leather products, non-metallic mineral products except products of petroleum and coal, hard board and particle board.

TABLE 2

Capital investment in chemical industries in UAR

	Capital investment in chemical industry Million L.E.	Capital invested in basic chemicals industry Million L.E. including fertilizers & petro-chemicals
First Five Year Plan (1960/1965)	170.6	74.7
Second Five Year Plan (1965/1970)	240	134
Total	410.6	208.7

The investment allocated for basic chemicals industry amounts to approximately 50.6 per cent of the investment required for the whole chemical industry in the first and second five year plans; which indicates the importance given to the basic chemical industry in UAR.

I. ACIDS

A. Sulphuric Acid

Sulphuric acid is one of the most important basic industrial chemicals. There is scarcely an important industry which is not directly or indirectly dependent to some extent on sulphuric acid, one of its salts or derivatives.

Among its uses in UAR are: the manufacture of fertilizers, petroleum refining, rayon industry; iron and steel industry, textile industry, the production of explosives, chemicals, pharmaceuticals, acid batteries, detergents, cotton seed oil and soap industry etc...

The production capacity and consumption of sulphuric acid in UAR in 1952 and in 1964 are given below:

Year	Production capacity tons(100%)/year	Consumption tons (100%) per year
1952	90,000	51,000
1964	260,000	170,000
per cent increase $\frac{1964}{1952}$	288 %	333 %

The production capacity of sulphuric acid in UAR is expected to reach 593,000 tons per annum in 1970. The following table shows the capacity of the existing and future plants, their location and the raw materials used.

No domestic sulphur or pyrites deposits are available in UAR, however small quantities of sulphur are extracted from refinery gases amounting to about 32,000 metric tons per annum.

In view of the large present day demands for sulphur, and the dwindling of easily accessible reserves in sulphur rich countries, it is becoming more difficult to import sulphur and at a reasonable price. Therefore, the idea was conceived that the extensionsin the sulphuric acid industry in the second five year plan should depend mainly on indigenous raw materials e.g. gypsum to ensure continuity of production and to minimize the use of foreign exchange in importing raw materials.

Name of plant	Location	Production capacity tons (100%) per year	Raw material
Existing plants:			
- Abou Zabal fertilizer & chemical co.	Abou Zaabal	40,000	Pyrites
- Société Financière et Industrielle Egyptienne	Kafr El Zayat	100,000	Pyrites & sulphur
- Misr Rayon Company	Kafr El Dawar	20,000	Sulphur
- Sociote El Nasr D'Engrais et D'industries Chimiques	Suez	100,000	Sulphur
Plants under construction			
- Assyut Fertilizer & Chemical Industries Co.	Assyut	83,000	Sulphur
Plants included in second Five Year Plan			
- Extension of Abou Zabal Fertilizer & Chemical Co.	Abou Zaabal	100,000	Sulphur
- Extension of Société El Nasr d'Engrais et Industries Chamiques.	Suez	250,000 under consideration & intended to replace the existing plant using sulphur and to serve a new superphosphate plant.	Gypsum

Extensive deposits of gypsum meeting the required specifications exist in Sinai Peninsula, which can be mined and transported to Suez by barges. Table 3 gives approximate production costs of contact sulphuric acid in UAR which have been estimated for plants of 70,000 tons annually in dollars.[1/]

TABLE 3

Estimated Production Costs of Contact Sulphuric Acid in UAR

Item	Gypsum	Sulphur	Pyrites
Raw materials	6.16	14.56	13.16
Conversion, including Fuel	11.48	2.80	6.16
Overhead interest and depreciation	10.92	3.36	7.00
	28.56	20.72	26.32
Less credits	5.88	0.84	0.84
Net Cost	22.68	19.88	25.48
Capital cost	95.20	26.60	54.60

It is evident from Table 3 that the process of production of sulphuric acid from gypsum is worthy of consideration. The cost of production of sulphuric acid using such a process is lower than that from pyrites. Its main advantages include the exploitation of local raw material, the saving in foreign currency expenditure and the continuity of production of sulphuric acid. One of the drawbacks of the process is its high capital cost but it must be looked upon as an investment in both sulphuric acid and cement industries.

1/ Modern Chemical Processes Vol.5.

B. Hydrochloric acid

Hydrochloric acid is an important mineral acid next only to sulphuric acid and nitric acid in importance. The principal uses of hydrochloric acid in UAR include the textile industry, chemicals and pharmaceutical industries.

Two firms in UAR produce hydrochloric acid by the synthesis process from chlorine and hydrogen and a third firm uses the salt cake process for its production. However, hydrochloric acid is obtained as a by-product from the DDT Factory at Kafr El Zayat.

The production capacity and consumption of hydrochloric acid in UAR in 1952 and in 1964 are as shown in Table 4.

TABLE 4

Production and Consumption of Hydrochloric acid

Year	Production capacity tons (100%)/year	Consumption tons (100%)/year
1952	1500	1000
1964	15000	3976
per cent increase $\frac{1964}{1952}$	1000 %	398 %

The production capacity of hydrochloric acid was deliberately increased in one of the firms which used the synthesis process with the purpose of disposing of the chlorine in form of hydrochloric acid, in case the chlorine produced in that firm during the first years of production was not totally utilized.

The existing large production capacity of hydrochloric acid which is partially exploited and the huge amounts of by-product hydrochloric acid obtained from chlorination process necessitated the non-expansion in the hydrochloric acid industry till 1970.

C. Nitric Acid

Nitric acid is a very important chemical for the manufacture of explosives, fertilizers and other chemicals used both in peace and war.

Nitric acid is manufactured in UAR by oxidation of ammonia in two nitrogenous fertilizer plants: the Egyptian chemical Industries "Kima" at Aswan and Société El Nasr d'Engrais et d'Industries Chimiques at Suez. In both plants the acid is obtained at a concentration of 53-55 per cent and is used for the production of calcium nitrate and calcium ammonium nitrate fertilizers.

The production capacity of nitric acid in both plants amounts to 445,000 ton (100 per cent) per year and the actual production in 1964 reached 342,000 tons (100 per cent). It is planned that the production capacity of nitric acid will reach 1.230 million tons (100 per cent) per annum after the execution of the nitrogenous fertilizers projects included in the second Five Year Plan as shown in Table 5.

Besides the nitric acid used for production of some nitrogenous fertilizers, there exists a unit for the production of concentrated nitric acid (98-99 per cent) with a capacity of 3,700 tons per year installed in Sociéte El Nasr d'Engrais et d'Industries Chimiques at Suez. The production of this unit is totally consumed in various nitration processes in military and civil production. It is foreseen to build another unit for the production of concentrated nitric acid having a capacity of 6,000 tons annually at El Nasr coke and heavy chemicals company at Helwan.

TABLE 5

Production Capacity of Nitric Acid

Name of plant	Location	Production capacity tons(100%)/year
Existing plants:		
- Egyptian chemical Industries "Kima"	Aswan	247,000
- Société El Nasr d'Engrais et d'Industries Chimiques	Suez	198,000
Plants under construction		
- Extension of Société El Nasr d'Engrais et d' Industries Chimiques	Suez	310,000
- El Nasr coke and heavy chemicals company	Helwan	
a- First line of production		95,000
b- Second line of production		95,000
Plants included in second Five Year Plan		
- Extension of Egyptian chemical Industries	Aswan	95,000
- El Nasr coke and heavy chemicals Co.	Helwan	
a- Third Line of Production		95,000
- Petrochemical Complex	Alexandria	
a- Calcium ammonium nitrate unit		95,000
Total		1,230,000

D. Phosphoric Acid

Phosphoric acid is not at present produced in UAR. The local need for phosphoric acid arises for the production of: sodium phosphates used in synthetic detergents industry; triplesuperphosphate fertilizer and chemical pharmaceuticals etc...

Therefore it was decided to include in the second five year plan a project for the installation of a phosphorus complex within the Kima works at Aswan to utilize the hydroelectric power generated from the High Dam power station and the phosphate rock mined from the Sibaaya mines in the Nile Valley. The phosphorus complex will include an electric furnace with a rating of 35,000 KVA to produce elemental phosphorus starting from raw phosphates. All the phosphorus will be converted to phosphoric acid, the latter will be utilized for the manufacture of the following end products:

(1) 100,000 tons per year of triple superphosphate (74 per cent soluble P_2O_5)

(2) 8,000 tons per year of tetrasodium pyrophosphate

(3) 8,000 tons per year of sodium tripolyphosphate

The balance of phosphoric acid is to be disposed of as such for use in other chemical industries. In addition, a feed grade dicalcium phosphate plant of capacity 12,000 tons/year is to be included, without corresponding facilities for acid production.

II. ALKALIES

A. Caustic Soda

Caustic soda is one of the most important heavy chemicals which has many uses particularly in the manufacture of viscose rayon, soap, paper, vegetable oils and textiles.

The production capacity and consumption of caustic soda in UAR in 1952 and in 1964 is shown in Table 6.

TABLE 6

Production Capacity and Consumption of Caustic Soda

Year	Production capacity tons (100%)/year	Consumption tons (100%)/year
1952	2500	16,400
1964	24000	60,000
per cent increase $\frac{1964}{1952}$	960%	366%

Two firms produce caustic soda in UAR by electrolysis using mercury cells. The production capacity of both firms is 24,000 tons per year and their actual production in 1964 reached 16,300 tons. The problem of by-product chlorine disposal is the major difficulty which confronts the achievement of full production so urgently needed to cut on the imports from caustic soda. The surplus chlorine amounts to 8,000-10,000 tons per annum and originated due to the abandoning of a project for the production of a certain chlorinated insecticide upon the advice of the Ministry of Agriculture. This surplus amount of chlorine will be utilized in the vinyl chloride plant which constitutes one of the units of the petrochemical complex to be installed at Alexandria.

Estimates of the industrial uses of caustic soda in UAR for 1964 are given in Table 7.

TABLE 7

Industry	Caustic M. Ton	Per cent
Rayon	13,000	22
Dyeing	6,600	11
Textiles	7,000	12
Petroleum	1,500	2
Paper	8,000	13
Chemicals	1,600	3
Soap Vegetable oils	16,200	27
Sugar	1,400	2
Starch	400	1
Miscellaneous	4,300	7
	60,000	100

The present uses of chlorine in UAR are limited and confined to the production of hydrochloric acid, ferric chloride, sodium and calcium hypochlorite, DDT, treatment of drinking water and of sewage and finally pulp bleaching. Future uses of chlorine will include the production of plastics and other petrochemicals.

The selection of the electrolytic process for production of caustic soda should be basically made when such factors governing the feasibility of the process are fulfilled e.g. availability of cheap common salt, cheap electric power and markets for chlorine and caustic soda.

The consumption of caustic soda in UAR is estimated to reach 70,000 tons per annum within the next five years. Since the present production capacity amounts to 24,000 tons per year, therefore, it has been decided to meet the local requirements from caustic soda by establishing an ammonia soda plant at Alexandria which is scheduled to start production in 1968. This plant is designed to produce:

(a) 32,500 tons/year dense sodium carbonate.

(b) 4,000 tons/year caustic soda.

(c) 5,000 tons/year sodium bicarbonate

and will also cover the local demand from sodium carbonate and sodium bicarbonate for several years to come.

B. Ammonia

Ammonia is a widely used base, essential for the production of nitrogenous fertilizers, ammonium salts, nitric acid, urea, and for use as a refrigerant.

The production capacity and consumption of ammonia in UAR in 1952 and 1964 are as follows:

Year	Production capacity tons/year	Consumption tons/year
1952	40,000	20,800
1964	223,000	185,000
Per cent increase 1952/1964	558 %	890 %

The production capacity of ammonia in UAR is expected to reach 717,000 tons per annum after the execution of the nitrogenous fertilizers projects included in the second five year plan as shown in Table 8.

TABLE 8

Production Capacity of Ammonia

Name of plant	Location	Production capacity ton/year
Existing Plants:		
- Egyptian chemical industries "Kima"	Aswan	138,000
- Société El Nasr d'Engrais et d'Industries Chimiques	Suez	85,000
Plants under construction		
- Extension of Société El Nasr d'Engrais et d'Industries Chimiques	Suez	130,000
- El Nasr coke and heavy chemicals Co.	Helwan	
(a) First line of production		52,000
(b) Second line of production		52,000
Plants Included in Second Five Year Plan		
- Extension of Egyptian Chemical Industries	Aswan	52,000

TABLE 8 (Cont'd)

Production Capacity of Ammonia

Name of plant	Location	Production capacity ton/year
- El Nasr coke and heavy chemicals Co.	Helwan	
(a) Third line of production		52,000
(b) Fourth line of production		52,000
- Petrochemical complex	Alexandria	
(a) calcium ammonium Nitrate Unit		52,000
(b) Urea unit		52,000
	Total	717,000

III. OTHER INORGANIC CHEMICALS

(a) Calcium Carbide

A calcium carbide and ferrosilicon plant with the capacity of 5,000 tons calcium carbide and 3,000 tons ferrosilicon (75 per cent Si) per year of 250 working days is under construction at Aswan. The plant is scheduled to start production in 1966, and will utilize cheap seasonal hydroelectric power obtained from the present Aswan Dam power station. The calcium carbide will be mainly employed for the production of acetylene required in oxy-acetylene welding, whilst ferrosilicon will be used for making alloy steel.

The present local consumption of calcium carbide amounts to 2,500 tons per annum and it is estimated that in 1970 the consumption will reach 7,000 tons. It is intended in the second five year plan to install a big plant for ferrosilicon to serve the projected expansion in the iron and steel industry, therefore the calcium carbide plant at Aswan will be made to produce calcium carbide only and consequently it will be able to provide all the country's requirements from carbide.

(b) Ferric chloride

Aluminium sulphate has been successfully substituted by ferric chloride as flocculating agent in the treatment of Nile-water in some of the drinking water stations.

It will be employed in the remaining stations which are still using aluminium sulphate after the necessary modifications in the equipment have been completed.

Ferric chloride is produced in UAR using the dry method by direct reaction of chlorine gas and iron scrap. The capacity of the plant is 4500 tons per annum which is considered ample to cover the country's requirements for several years to come.

(c) Aluminium Sulphate

The rapid expansion of paper industry in UAR made it necessary to plan the manufacture of some of the paper chemicals locally. One of the most important chemicals in this respect is aluminium sulphate. Two units for the production of aluminium sulphate have been included in the second five year plan with a capacity of 18,000 tons per year on the basis of importing the required alumina and treating it with sulphuric acid produced locally.

(d) Sodium sulphide

The second five year plan includes a project for the manufacture of sodium sulphide required for leather tanning, viscose rayon industry and for the production of some kinds of dyestuffs. Sodium sulphate resulting from viscose rayon industry as well as coke breeze will be used as raw materials. The annual production capacity is 1800 tons.

IV. ORGANIC CHEMICALS

(a) Alcohol

Ethyl alcohol is produced in UAR by means of fermentation of molasses obtained from sugar mills. The manufacturing and distilling capacity of the existing plant at Hawamdiah amounts to 20 million litres per year. The actual production of ethyl alcohol in 1952 was 11.1 million litres and in 1964 the production increased to 19.36 million litres. It is planned to raise the production capacity of the Hawamdiah plant from 20 to 25 million litres per year by 1970 in order to meet the increasing local consumption and to export the surplus production.

Butyl alcohol is to be produced for the first time in the last quarter of 1965 by the Organic Chemical Industries Co. at Hawamdiah. The production capacity of this plant is approximately 1350 tons per year of butyl alcohol. The process used is by fermentation of molasses and rice bran.

A unit for the production of methyl alcohol with a capacity of 10,000 tons per year has been included in the petrochemical complex to be installed at Mex, Alexandria. The main use of methyl alcohol is for the manufacture of formaldehyde.

(b) Acetone

Acetone is to be produced together with butyl alcohol in the works of Organic Chemical Industries at Hawamdiah at a rate of 600 tons per annum. Also, acetone will be obtained as a by-product from the phenol plant to be included in the petrochemical complex at Alexandria. It is estimated that 3500 tons of acetone per year will be produced from the said plant by 1969-1970.

(c) Formaldehyde

Formaldehyde is made from methanol at military factory no. 81; the capacity of the formaldehyde plant is 500 tons per year. The second five year plan includes two projects for the manufacture of formaldehyde having a total capacity of 18,000 tons per year. The bulk of production is intended for use in the manufacture of synthetic resins and moulding powders.

Another plant for production of para formaldehyde with a capacity of 900 tons per year is included in the second five year plan. The main purpose of producing para formaldehyde (a concentrated form of formaldehyde) is to facilitate the transportation of formaldehyde and to cut down on transport expenses.

(d) Plasticizers

It is intended in the second five year plan to install a plant for the production of plasticizers (di-butyl, di-octyle, di-ethyl phthalate) required for the compounding of PVC to be produced in the petrochemical complex at Alexandria.

The plant is to be executed in three successive stages:

(i) First line, to produce 4000 tons per annum of plasticizers.

(ii) Second line, to produce 400 tons per annum of plasticizers.

(iii) Facilities to produce the raw materials for both lines by the utilization of coal tar distillates.

(e) Nitrobenzene; aniline

Nitrobenzene and aniline plants are under construction in military factory No.18, with a capacity of 750 tons and 570 tons per year on the basis of one shift respectively. Aniline will be mostly used for the manufacture of dyestuffs and Sulpha drugs, whilst Nitrobenzene will be used as a raw material for making aniline.

(f) Chlorosulphonic acid

A 5 tons per day chlorosulphonic acid plant has been completed within the Chemical Pharmaceuticals Plant at Abou Zaabal. The acid is consumed for the production of Sulpha drugs. Chlorosulphonic acid is made from hydrochloric acid and oleum.

V. INDUSTRIAL GASES

(a) Oxygen

Oxygen is manufactured from liquid air as well as by the electrolysis of water. This gas is mainly used for oxyacetyleno welding. The production capacity of the existing oxygen plants in UAR is 3.565 million cubic meters per year; the production in 1964 from oxygen reached 3.456 million cubic meters. Measures are being taken to add a new unit with a production capacity of 320 cubic meters per hour to satisfy future needs.

(b) Acetylene

Acetylene is made from calcium carbide and is mainly used for oxy-acetylene welding. The capacity of the existing acetylene plants is 1.05 million cubic meters per year, the production in 1964 reached 650,000 cubic meters. A project for the addition of a new acetylene generator with a capacity of 112 cubic meters per hour is included in the second five year plan.

(c) Carbon dioxide is obtained as an important fermentation by-product, it is also manufactured on industrial scale by the complete combustion of liquid hydrocarbons. It is used by the fast growing carbonated beverage industry, in fire-extinguishers and also as a refrigerant in form of dry ice, the use of which has not yet been fully developed in UAR. especially for preservation of food stuffs. The capacity of the existing plants is 8000 tons per year and the production of carbon dioxide in 1964 amounted to 3400 tons. No plans are set to increase the production capacity of carbon dioxide because the present capacity is considered ample till 1970.

(d) Nitrous oxide

Nitrous oxide is manufactured locally by the thermal decomposition of ammonium nitrate. The capacity of the plant is 30 tons per year and the production in 1964 amounted to 8 tons only which represents more or less the local consumption from this anaesthetic.

VI. PRODUCTS OF COAL CARBONIZATION

It was natural to establish coal carbonization industry in UAR to provide the iron and steel industry with its present requirements from metallurgical coke. A coke oven plant was built at Helwan near the iron and steel works for this purpose; the plant was started up in April 1964 and reached full production in March 1965. The coking coal needed for the plant is being imported from USSR and some research is conducted at the moment to replace it wholly or partly by local coal from Maghera area in Sinai.

The capacity of the plant is as follows:

Product	Tons/year
Coke	330,000
Light oils	
– Benzol	2,400
– Toluene	520
– Xylene	110
ammonium sulphate	4,800
Dehydrated coal tar	12,800
Raw phenol	95
Coke oven gas	133 million cubic meters

The coke oven gas obtained is being used partly for heating the battery and for steam raising. The remaining part is intended for use for manufacture of ammonia in the adjacent nitrogenous fertilizer plant which is under construction and scheduled to start production in the second half of 1967.

It has been decided in the second five year plan to raise iron and steel production in Helwan area to 1.5 million tons per year. Therefore it will be necessary to increase the metallurgical coke production up to 1.3-1.5 million tons per year to cope with the projected iron and steel capacity. A contract has been concluded to this effect with a Soviet Organization for the construction of the metallurgical complex at Helwan for the dual expansion of the iron and steel works and the coke oven plant as well. Also the contract covers the distillation and fractionation of the coal tar obtained into its various components which are to be used as raw materials for the manufacture of dyestuffs, insecticides, pharmaceutical chemicals, plastics, plasticizers, synthetic fibres etc.....

The coke oven gas resulting from the present and future coke oven plants is to be processed into nitrogenous fertilizers namely calcium ammonium nitrate (600-800 thousand tons 20.5 per cent N_2 per year) and urea (95,000 tons 46 per cent N_2 per annum).

VII. DYESTUFFS AND INTERMEDIATES

A dyestuffs and intermediates plant is under construction near Ismailia, UAR. The plant will be started up in the second half of 1967 and will produce the following types of dyestuffs and intermediates:

Type	Tons/year
1 - Direct and fast to light dyes	715
2 - Acid dyes	117
3 - Wool Mordant dyes	50
4 - Sulphur dyes	30
5 - Naphthols	100
6 - Naphthol Bases	32
7 - Aniline salts	500
8 - Intermediates	500
- Beta naphthol - H- Acid - Betahydroxy naphthoic acid - O-Benzensulphonyle-H-acid	300
9 - Vat Dyes	675
10 - Intermediates for Vat dyes	400

The know-how and equipment for the production of Vat dyes and their intermediates have been supplied by an Italian firm whilst those for the other dystuffs were furnished by a Polish Organization. The estimated capital investment for this plant is 14 million Egyptian pounds including the cost of the colony for housing the plant employees and workers.

VIII. PETROCHEMICALS

Petrochemical industry started in UAR in 1951 when a nitrogenous fertilizers plant utilizing petroleum refinery gases at Suez began production. Besides, elemental sulphur was recovered from the said gases to enable their use for that purpose.

The outlines of the development programme in petrochemical industry to be executed till 1970 can be summarized as follows:

(1) Expansion of nitrogenous fertilizer production based on petroleum feedstocks at Suez from 385,000 to 1,120,000 tons per year (calculated as 15.5 per cent N). This expansion is to be carried out in two stages: the first stage is under construction at present and would increase the production by 470,000 tons per year by the end of 1967; and the second stage is still in the contracting stage and is expected to produce 265,000 tons in 1969.

(2) Production of benzol, toluene, elemental Sulphur and dodecyl benzene at the new refinery completed at Suez in June 1965 including a delayed coking plant. The production capacity of benzol and toluene is 15,000 tons, of sulphur 28,000 tons and to dodecyl benzene 6,000 tons per year.

(3) Installation of a petrochemical complex at Alexandria UAR. The complex is to utilize as a raw material part of the surplus naphtha obtained in local refineries. There are ten different plants included in the complex. The capacity of each plant is given below:

Name of plant	Capacity (tons/year)
1 - Ethylene plant	35,000
2 - Polyethlene plant (high pressure)	15,000
3 - Polyvinyl chloride plant including facilities for monomer production	20,000
4 - Phenol plant (cumene process)	6,000
5 - Acrylonitrile momomer plant	5,000
6 - Caprolactam plant	4,000
7 - Polybutadiene plant	12,000
8 - Calcium ammonium nitrate plant (20.5 per cent N)	200,000
9 - Urea plant	95,000
10 - Methyl alcohol plant	10,000

The selection of products, capacities, processes for the various units of the complex required a great deal of careful studies. Priority was given to products that can substitute traditional imports e.g. Jute, natural wool, natural rubber, rayon tyre cord, and synthetic resins and plastics.

The process evaluation for each product has been completed and all the selected processes have been purchased, with the exception of the processes for the production of acrylonitrile and polybutadiene which will be purchased in the near future.

The project is expected to go on stream by 1969 and the total capital investment needed for the petrochemical complex is estimated to be 110 million dollars.

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